MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

HMB2011 – INTRODUCTION TO MOLECULAR BIOLOGY

(All section / Groups)

20 OCTOBER 2016
2.30 pm - 4.30 pm
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **13** printed pages including the cover page with **5** questions only.
2. Attempt all **FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the spaces provided in this question paper.

QUESTION 1

a. What is the biological significance of negative autoregulation?

[2 marks]

b. Using the *ara* operon as an example, explain how an operator regulates the expression of a gene that is distant from it. Illustrate your answer with a simple diagram.

[3 marks]

Continued...

c. What are the experimental approaches used by Alfred Hershey and Martha Chase to demonstrate that DNA is the genetic material?

[2 marks]

d. Briefly explain how a nucleic acid sample is evaluated for its quantity and purity using a spectrophotometer.

[2 marks]

Continued...

e. What is the most economic way to dispose of ethidium bromide solution?

[1 mark]

QUESTION 2

a. Explain any four additives which can enhance PCR performance during gene isolation research?

[2 marks]

b. How do you interpret the role of insulator element in the regulation of gene expression?

[1 mark]

Continued...

c. Figure 1 represents the inhibition of the IRE-binding protein by iron. What kind of inhibition is the iron mediating? Explain your reason.

[3.5 marks]

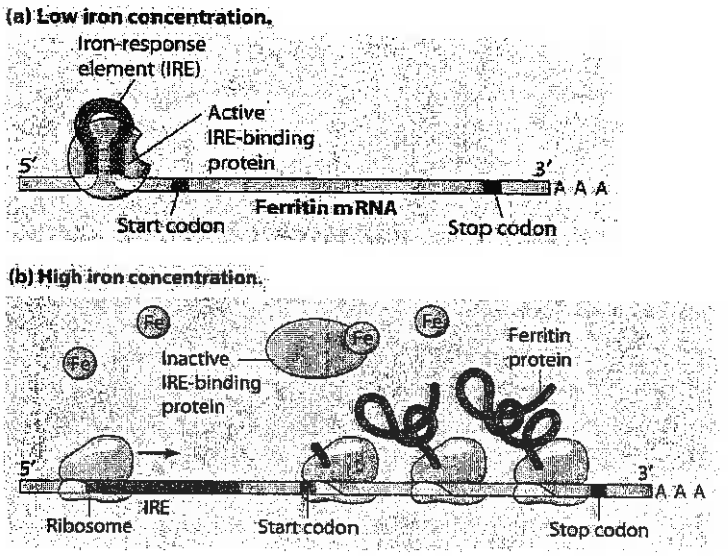

Figure 1

Continued...

d. The human β-interferon gene is activated in cells upon viral infection. With the aid of a diagram, compile all activators which bind cooperatively to the site activating β-interferon gene.

[3.5 marks]

Continued...

QUESTION 3

a. With the aid of a diagram, demonstrate the initiation of meiotic recombination in eukaryotes?

[4 marks]

Continued...

b. A plant breeder wants to isolate mutants in tomatoes that are defective in DNA repair. However, this breeder does not have the expertise or equipment to study enzymes in DNA repair systems. How could the breeder discover tomato plants that are deficient in DNA repair? What are the traits to look for?

[1.5 marks]

c. If the transposable element *Ds* of maize transposed by the same mechanism as Tn3, would we see the speckled kernels with the same high frequency? Explain your answer in brief.

[1.5 marks]

d. Why is it important in mismatch repair that the cell distinguish the parental strands from the newly synthesized strands? How is this accomplished?

[1.5 marks]

Continued...

e. Which DNA repair system is missing in most cases of xeroderma pigmentosum (XP)? Why does that make XP patients create extreme sensitivity to UV light?

[1.5 marks]

QUESTION 4

a. A bacteriophage lambda infecting a host cell in a rich medium expresses the *cI* gene even though it has a wild type *cro* gene. Offer one short explanation for how this situation can occur.

[2 marks]

b. What is the advantage of phage lambda vector as compared to plasmid cloning vector?

[1 mark]

Continued...

c. How can DNA fragments of various sizes (larger and smaller) be separated? Name the techniques used for visualization of the DNA fragments.

[2.5 marks]

d. A genetic engineer wants to isolate a gene from a papaya that encodes for gamma tocopherol gene, with the ultimate purpose of transferring this gene to bacteria and producing the food additive for use as a commercial vitamin E. Isolating the gene requires a DNA library. Should the genetic engineer create a genomic library or a cDNA library? Explain your reason.

[2.5 marks]

Continued...

e. Distinguish the difference between the `knockout' and `knockdown' of a gene?

[2 marks]

QUESTION 5

a. Why would researchers want to create crop plant that expresses the BT toxin protein of *Bacillus thuringiensis*?

[1 mark]

b. Fluorescence in situ hybridization (FISH) become an increasingly demanded tool for biomarker research and personalized medicine. What is the reason that researchers need to use this method rather than Southern blotting?

[1 mark]

Continued...

c. Many types of DNA sequencing involve a DNA synthesis reaction in which labeled nucleotides are incorporated. However, some of sequencing method use gel electrophoresis platform but others use automated platform. When employed in DNA sequencing, explains the purpose of gel electrophoresis with an example.

[4 marks]

d. During preparation of plasmid DNA for sequencing, you used ampicillin as selectable marker. You have 50µg/ml of ampicillin stock. How much you should take from the ampicillin stock solution if you want to cultivate the single colony of bacteria in 10ml growth media supplemented with 0.25µg/ml ampicillin?

[2 mark]

Continued...

e. Compare and contrast 'comparative genomics' and 'functional genomics'.

[2 marks]

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